

Wildflowers and Butterflies

at Mill Waters heritage site

TN
TEACHER'S NOTES

TITLE SLIDE

In this lesson you will learn about wildflowers and the butterflies and bees that pollinate them in and around Mill Waters. We will also be looking at the life cycle of the butterfly and why they are so important to the ecosystem and humans.



SLIDE 2

WILDFLOWERS AT MILL WATERS

Wildflowers are just that! They grow in the wild, usually without humans planting them. They adapt to the local conditions and can often survive despite variable weather, disease and pests in that environment.

There are lots of different wildflowers at Mill Waters. Let's find out why they are so important...

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SLIDE 3 WHY DO WE NEED WILDFLOWERS?

Some of the flowers we see in our own gardens are wildflowers that we consider to be weeds and a bit of a pest, such as daisies and dandelions. But they actually play an important role in the wildlife ecosystem helping to feed bees, butterflies and other insects, who, in turn help to pollinate the crops that we eat.

Insects and bees are attracted to the brightly coloured flower to drink the nectar inside them; as they collect the nectar, they pick up pollen from the inside of the flower, which they then carry to another plant. If pollen is able to travel from a plant to another plant of the same species then that plant will be able to make seeds and reproduce.

We need a wide range of wildflowers to provide pollinators (bees and other insects that pollinate plants) with local food sources throughout the year – including times when crops aren't producing flowers.

Many of our favourite fruits, vegetables and nuts rely on insect pollination. For example, in the UK strawberries, raspberries, cherries and apples need to be pollinated by insects to get a good crop. Insects do this job for free!

The flowers we choose for our gardens are often picked because they are a pretty colour or smell nice, but they may not be as resilient and usually need help from humans to thrive.

SLIDE 4 LIFE CYCLE OF A FLOWER

Each species of wildflower will have developed in a certain habitat such as in a woodland, near a river or body of water, or open farmland and will favour that type of habitat. Some prefer shade, others like full sun. All of them will need water (unless they have adapted to a desert-like environment) and they will require insects, bees and butterflies to pollinate them for their survival.

Flowers come from seeds, and they create seeds too. All flowering plants go through the following life cycle:

- Germination is the process by which a plant begins to grow from a seed. Roots form under the soil. The stem, leaves and flower emerge above the soil.
- Pollen produced by a flower is carried by insects or blown by the wind to another flower. This process is called pollination.
- When the pollen reaches another flower, it travels to the ovary where it fertilises the egg cells to make seeds. This process is called fertilisation.
- These seeds are scattered by animals or the wind. This process is called dispersal. Some of the seeds will grow into new plants.

Plants need water, air, sunlight and nutrients to grow, in particular nitrogen (which is found in the atmosphere), phosphorus, and potassium (types of mineral). Nitrogen is necessary for making green leaves, phosphorus is needed for making big flowers and strong roots, and potassium helps the plants fight off disease.

- The roots take food and water from the soil
- A stem carries food and water
- The leaf collects sunlight
- The flower attracts insects

Let's watch this short clip to find out a bit more about the stages of a plant's life cycle: <https://www.bbc.co.uk/bitesize/topics/zgssgk7/articles/zyv3jty>

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SLIDE 5

FLOWERS AND POLLINATION

Plants have adopted many traits to attract pollinators. Bright coloured blossoms attract bees, flies, butterflies, and moths inside to collect nectar and pollen.

Sometimes lines on their petals will guide the insects down into the blossom, or a sweet smell will attract pollinators from a long way off.

When the insects go about collecting nectar, they spread the pollen to other blossoms on that plant and others nearby. Plants have open flowers with ray or disc blossoms – dandelion, daisies or foxglove – where any insect can land, collect nectar and carry pollen onto another flower.

The bee's feet work the petals open, they bounce down, like a trampoline, and the petals spread. The stamens inside are covered with pollen and pop up to dust the bee's belly. If the bee has been to another blossom already, the pistil, which also touches the bee's belly, gets a dose of the pollen already stuck there and pollination occurs.

When the seeds form, they will be carried by the wind, animal fur and birds who will disperse them where some will grow. For a seed to successfully grow it must have water, sunlight and soil, just like its parent plant.

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SLIDE 6

WHY SHOULD WE CARE ABOUT THE LOSS OF WILDFLOWERS?

Wildflowers can act as a habitat for wildlife: the right wildflowers can attract various types of bees, bugs and butterflies. They, in turn, will attract wildlife which will then start nesting in the habitats provided.

Wildflowers also contribute to scientific and medical research. Some UK native wildflowers contain compounds which can be used in drugs to treat diseases. For example, foxgloves (*Digitalis purpurea*) contain chemicals used to treat heart conditions. If we were to lose these and many other wildflower species, we could lose potential new medicines. Of the 252 drugs considered “basic and essential” by the World Health Organisation, many are of flowering plant origin. Drugs like codeine, quinine, and morphine all contain plant-derived ingredients.

Extracts of many wildflowers are also traditionally used to treat health conditions. Lavender can be used to treat anxiety. Extracts of Echinacea is used to relieve the symptoms of the common cold. Aloe Vera treats heart conditions, diabetes and speeds up wound healing.

As well as having health-giving properties the world would not be a very colourful place without our wildflowers – they are beautiful and provide us with habitats that buzz with life.

Plants underpin all life on earth, they provide the oxygen we breathe and the food we eat, as well as making up the backbone of the world’s ecosystems – so plant extinction is bad news for all species. About three-quarters of Earth’s land, two-thirds of its oceans and 85 per cent of crucial wetlands have been severely altered or lost according to a report published by the UN published in 2019.

The loss of forests, areas of grasslands and changes to the way in which we farm is making it harder for species to survive. Inappropriate management of woodland and roadsides has also led to the loss of important habitats for many small animals and insects. A study found that 571 plant species have disappeared in the last 250 years.

There is also a threat posed by climate change. Most plants and animals live in areas with very specific climate conditions, such as temperature and rainfall patterns, that enable them to thrive. Any change in the climate of an area, the temperature, rainfall, too much or too little sun, can affect the plants and animals living there. They cannot adapt quickly to these changes and so their numbers fall.

Bluebells are one of Britain’s most protected plants despite being relatively common. This is because Britain has about 30 per cent of the total world population of bluebells and there is a thriving trade in wild bluebell bulbs. Even in Britain, it is still illegal to take wild bluebell seed without the landowner’s consent.

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SLIDE 7

LIFE CYCLE OF THE BUTTERFLY

There are about 17,500 different types of butterfly in the world, of which 59 species live in the UK. Sadly, the number of butterflies has declined by over half in the last 20 years, with three-quarters of British butterflies in decline. Protecting their wildlife habitat is essential to prevent them dying out, not least because butterflies are an important element of the food chain; along with the moth, they are indicators of a healthy environment and ecosystems.

Butterflies come in a dazzling range of colours and intricate wing patterns. Many butterflies have iridescent wings. Iridescence is seen when a surface, like a butterfly wing, appears to change colour as the angle of light changes. The giant swallowtail caterpillar has notable markings which resemble bird droppings, helping to camouflage it from predators. They use this, along with their 'osmeteria', to defend against predators such as wasps, flies, and vertebrates. The osmeteria is a gland which some caterpillars have which they can stick out when they feel threatened; it contains strong-smelling chemicals that deter predators.

But do you know how butterflies start out in life?

The transformation from egg to caterpillar to chrysalis before an adult caterpillar emerges is one of the wonders of nature. It is called metamorphosis.

Butterflies undergo a fascinating four-stage life-cycle, starting as tiny eggs laid on leaves in which the larva (or caterpillar) forms.

Eggs can hatch after a few weeks or remain dormant for a season (usually winter) before emerging. Once hatched, caterpillars vary massively in size, shape and colour depending on species. Some are furry, some spiky, some camouflaged, some smooth. All caterpillars love to eat and will munch their way through a large amount of mostly green leaves to store up energy for their next phase - the chrysalis.

The chrysalis (or pupa) stage of a butterfly's life-cycle sees it transformed from shuffling caterpillar to free-flying butterfly. The caterpillar surrounds itself with a protective case and anchors itself to a plant.

Finally the insect emerges from its cocoon as a fully formed butterfly, ready to find a mate and start the process all over again! At this stage some butterflies will travel miles in order to breed. The Painted Lady is a long-distance migrant, arriving in the UK every year and breeding here during the warmer months, with the offspring then emigrating southwards.

Butterflies can get the nutrients and minerals they need from a muddy puddle in a sunny area. A successful butterfly habitat will contain the plants favoured by both caterpillars and butterflies. Many natural butterfly habitats have been destroyed or

affected through the construction of housing and shopping developments, as well as by the use of pesticides and other chemicals.

Watch this video clip of a larvae developing through pupa stage to become a Monarch butterfly.

www.youtube.com/watch?v=7AUeM8Mbalk&form=IPRV10

Handout 4 provides an overview of the early beginnings of the butterfly and other life forms, namely the frog, the flower and the water vole (a mammal). Below is a short explanation of the 'early beginnings' of frogs and water vole. Teachers are expected to take a view on how much detail they want to go into about sexual reproduction.

FROG

The female frog lays her eggs in the water and the male spreads sperm over the eggs to fertilise them. When several eggs are clumped together, they are known as frogspawn. The surrounding jelly provides support and protection and allows oxygen, carbon dioxide and ammonia into the egg for development. It absorbs moisture and swells on contact with water.

After fertilisation, the very inside of the egg becomes more liquid and gives the developing embryo more movement. Larvae developing in the eggs can detect vibrations caused by nearby predatory wasps or snakes, and will hatch early to avoid being eaten.

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The larvae that emerge from the eggs, known as tadpoles or polliwogs (a baby frog or toad), typically have oval bodies and long tails. Tadpoles are highly vulnerable to being eaten by fish, newts, diving beetles and birds, such as kingfishers. At the end of the tadpole stage, a frog undergoes metamorphosis - its body makes a sudden transition to become an adult.

Frogs are at their most vulnerable to predators when they are undergoing metamorphosis. At this time, the tail is being lost and they are only just starting to move their limbs. This image shows a tadpole almost developed through metamorphosis into a frog, although he still has his tail.

WATER VOLE

Water voles reproduce by usually having three or four litters a year, depending on the weather. There are about five young in a litter (and the total will weigh 1 ounce!) They are born below ground in a nest made from grasses and rushes. Although blind and hairless at birth, young water voles grow quickly and are weaned (stop feeding off their mum) at 14 days.

The reproduction cycle of voles is so fast it sounds unbelievable. A female vole will mate before she is two weeks old and grow the babies for between two and three weeks. So, she could only be one month old when her babies are born. The male leaves her after mating and goes off to find another female to mate with.

Consider that any female baby vole in that first litter will also have her first litter in one more month, you can see how they can soon take over an area.

In fact, according to the wildlife trust, the population of water voles decreased in Britain by 30% between 2006 and 2015 due to the effect of habitat destruction and pollution of rivers and other water habitats.

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SLIDE 8 HERMITAGE MILL

Both the bumblebee and the bees which feed on nectar produce honey. However, the bumblebees produce only a small quantity of honey compared to that of the honeybee.

Bumblebees are larger than normal bees. Bumblebees do not lose their sting and die after they use it, as in the case of the regular bees.

Bees produce honey from the nectar and store it in wax structures called honeycombs.

As honeybees gather pollen and nectar for their survival, they pollinate the flowers, plants and fruit trees that they visit. Some species of plants depend entirely on the honeybee for pollination. Their flowers bloom nearly always in the summer months, only a few during the winter, which is why we don't see bees and butterflies through the winter.

There are many dangers to the survival of the bees and honeybees:

1. Insecticides are chemicals that farmers use to kill insects damaging their crops. They are meant to kill insects which damage crops and are widely spread by farmers. Sadly, they also kill bees and other very useful insects.
2. Unfortunately, given the increasing one-crop farmlands, bees don't get the mix of plants they need

for a healthy diet. Where there are a mix of smaller crops bees have enough time to forage for pollens in varied fields, which keeps them healthy.

3. Queen bees now have increasingly short lifespans. Not only do they stop living as long, but they mate just once in their lives. The amount of sperm the queen bee gets determines the length of her reign.

4. Climate change is also partly to blame. With extreme weather events, changes in rainfall patterns and increasing temperatures.

All of these factors affect the bee population and other pollinators. In 2019 scientists estimated that a third of British wild bees and hoverflies were in decline.

Hoverflies have only two wings in comparison to the bee who has four. There are many more hoverfly pollinators than bee pollinators, so they are very important to ensure we have sufficient fruit and vegetables to eat.

SLIDE 9 REWILDING MILL WATERS

The wildflowers at Mill Waters not only make the site more attractive for human visitors, they offer a tantalising display which attracts lots of different pollinator species.

It is really important we conserve these wildflowers at Mill Waters because so many of our wildflower meadows around the world have been destroyed in order to build factories, houses and roads, as well as because of extreme weather, flooding and disease.

Once nature is given a helping hand it doesn't take long to restore its ecosystem. When flowers and plants grow, insects (namely bees and butterflies) and small animals will follow. They are then fodder for species further up the food chain.

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LEARNING ACTIVITIES

1. Draw a flower and name the parts.

Refer to Handout 1 and draw a diagram of a flower and name the different parts. Underneath explain what each of the different parts do.

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LEARNING ACTIVITIES

2. Classroom discussion about pollination.

Based on what you have learnt from the Teacher's Slides and referring to Handout 2 have a discussion with your class about the role of bees and butterflies at Mill Waters and the decline of wildflower meadows. Here are a few questions to start the debate:

- **Why are the bees and butterflies important at Mill Waters?**
To fertilise the wildflowers and plants for a healthy ecosystem.
- **Can you name three wildflowers at Mill Waters?**
See Handout 6 for examples.
- **Can you name two butterflies at Mill Waters?**
See Handout 5 for examples.
- **Why do the bees and butterflies come to Mill Waters?**
They have what they need to survive: weather conditions, water, food from the plants.
- **What would happen if there were no bees or butterflies at Mill Waters?**
Wildflowers would not be pollinated. There would be no further plant growth and animals would then begin to suffer too. The whole ecosystem would fail.
- **What can we all do to protect the habitat for the wildflowers at Mill Waters?**
Protect the habitat by not disturbing the wildlife. Don't make habitats smaller or change them in any way. Don't pick wildflowers. Tread lightly and avoid damaging wildlife habitats. Reduce the pollution of streams and rivers.

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LEARNING ACTIVITIES

3. Quiz: Early Beginnings.

Using Handout 4 match these very young species with their adult selves. Focus on butterflies (chrysalis), frogs (spawn), birds (eggs) and water vole (mammals).

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LEARNING ACTIVITIES

4. Look and find field-based activity.

During the late spring / summer you may find these species at Mill Waters. (Handout 5)

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LEARNING ACTIVITIES

5. Write an article about the rewilding at Mill Waters

Supported by Handouts 3 and 6:

Imagine that you are responsible for managing the land around Mill Waters to promote the wildlife living there. Write an article for Ashfield District Council's website about why it is important that the wildflowers are protected at the site (to attract pollinators).

Describe some of the species of wildflowers you might find at Mill Waters and include any special properties they may have. What are their Latin names and their common names? Can you eat it, or can it be used to help heal or ease a health problem?

Perhaps you could take photographs of the wildflowers at the Mill Waters site to illustrate your article, or produce a coloured drawing using photographs of one of the wildflowers from the internet, to illustrate your piece of writing?

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LEARNING ACTIVITIES

6. Create your own wildflower garden

Visit the Wildflower Garden website for tips on planting wildflowers with children: <https://plantlife.love-wildflowers.org.uk/wildflower>

Check which butterflies visit your area before planting your seeds. There are flowers that butterflies are particularly attracted to. Read the back of the seed packet.

Choose a sunny patch of ground, rake it and level it before sowing your seeds.

You don't need to cover the seeds but tread them into the ground and water them regularly. Don't forget to add a feeding station in your garden, preferably off the ground. Use very small containers, the size of a saucer or less, with a supply of water or a sponge soaked in sugar and water to attract your bees and butterflies.

Sown at the right time of year, your seeds will grow well and you could attract hedgehogs, frogs, toads and newts, lizards and snakes, bees, creepy crawlies, dragonflies and damselflies, bats, butterflies and moths, small mammals or birds.